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ABSTRACT

The staff of the Hueneme School District, working in partnership with GTE California, Inc., developed a "Smart-Classroom," a high-technology seventh-grade science class facility which integrates personal computers, interactive laser disk video programs, closed circuit television, VHS programs, satellite down links, local area networking, and phone modems. One hundred ninety-two students, including students from the gifted and talented program, special education program, and limited English proficient students, were enrolled in the Smart-Classroom. The use of technology in the classroom enabled these students to progress through lessons at their own pace, thereby maximizing student achievement, which is the main goal of the program. At the end of each unit, criterion-referenced computer tests were given to determine if content objectives had been mastered. Any objectives missed were automatically retaught by the software program and tested again. This individualized approach enabled students to master the objectives at their own speed. One area of improvement was in the students' attitudes toward learning. Students started at their appropriate level and progressed at their own speed. As they experienced success, they gained confidence in themselves. They realized they could progress as far and as fast as they wished, and were eager to accept new challenges. (Blueprints of first and second generation Smart-Classrooms are appended.) (Author/GL)

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# PRACTICAL IMPLEMENTATION OF EDUCATIONAL TECHNOLOGY

## The GTE/GTEL Smart-Classroom

## The Hueneme School District Experience

by

Ronald C. Rescigno, Ed.D.
District Superintendent
Hueneme School District

Submitted for the United States/
Union of Soviet Socialist Republics
Joint Conference on Computers, Education and Children

October 1 - 9, 1988

Sponsored by the Association for the Development of
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## The Smart-Classroom - A Smart Idea

The Smart-Classroom is a classroom supported by an infrastructure which provides the capacity and connectivity necessary for all data, voice, and video applications. The promise of the Smart-Classroom is the creation of an interactive learning classroom where the integration of all learning--the theoretical with the practical, the understanding with the senses--is the essence of education; where the computer and other electronics are the primary information delivery system for the basics of the academic subjects; and where human resources education is highly integrative. The Smart-Classroom makes learning interactive for all students allowing the teacher time to pay attention to the needs of each student by individualizing the learning experience.

The Smart-Classroom has evolved from the Hueneme School District's educational staff planning and implementing successful learning units, curriculum reviews, and electronic delivery systems. In 1979-80, district staff developed an in-house computer management system for proficiency testing, creating teacher made tests, and ordering supplies. Called CHARMS, the program used Commodore Pet computers and Chatsworth Card Readers.

Frustrated by its limitations and the over-all lack of good educational software, district personnel began searching for and visiting various programs nationwide and in Canada.

In Provo, Utah, district personnel visited the WICAT Education Institute and Waterford School. WICAT is an acronym for World Institute of Computer Assisted Teaching. Impressed with the educational content and available curriculum of WICAT, in the spring of 1983 the district installed four labs in three Chapter 1 kindergarten through grade six elementary schools and one sixth through eighth grade middle school. At present, each of the district's nine elementary schools has one lab with four labs in the two middle schools. One of the elementary schools runs a distributive system off of the lab configuration. Both middle schools run computer distributive systems in sixteen classrooms. A distributive system consists of a bank of eight to ten computer terminals in a classroom. The computers run language arts, reading, math, word processing, French language development, and English second language software with a teacher management system.

The district was one of the first in the United States to install International Business Machines (IBM) Writing to Read labs in 1984. Following closely, IBM offered the district the opportunity to be an alpha test site for their Spanish Writing to Read Program.

Continued experiences with the Apple Corporation's English as a second language lab, Apple's and IBM's word processing/ graphic labs, laser disk interactive instruction, V.H.S. large screen video instruction, CD-ROM instruction, closed circuit television, educational cable television, down link/up link satellite transmissions, data transmission using PC's, Mac II's, RCA and Sony monitors, modems, and robotics pointed to the potential for bringing to the individual learner station a new and exciting delivery system.

The district's extensive experience with the integration of technology into the curriculum, beginning with the stand-alone computer, to the stand-alone computer lab, to a distributive system, eventually led to the complete integration of electronics into the teacher delivery system, i.e., the Smart application. The Smart application is a multi-media educational delivery system integrated with a unified curriculum in a co-curriculum environment.

## The Partnership

Partnerships between education and America's corporations are becoming more and more common. They are entered into for many worthwhile reasons; from direct teacher grants to student incentive programs. In 1986-87, the district joined in a "Partners in Education" agreement with GTE California, Inc., to develop an on-campus Smart-Classroom. It allowed GTE to learn more about the needs of kindergarten through eighth grade education while Hueneme School District learned more about

technology and classroom application. Subsequent agreements with Software Management Service of Los Angeles for systems hardware and software integration, and Edunetics Ltd., to provide the science software for the unified curriculum were finalized.

## First Generation Smart-Classroom

The first generation Smart-Classroom is a seventh grade science class facility located at E. O. Green Junior High School campus in the Hueneme School District in Port Hueneme, California. The district is located near Oxnard, California, about sixty miles north of Los Angeles and about forty miles south of Santa Barbara in Ventura County. The district has approximately 7,000 kindergarten through eighth grade students and 284 teachers in nine elementary schools and two middle schools. The student population is 63 percent minority. Forty-four percent of the students are Hispanic.

The Smart-Classroom was designed to improve the learning environment of students by delivering a traditional science curriculum through a quite non-traditional means--an interactive computer network with a wide range of fully integrated electronic technologies.

The project converted a standard 30' by 30' classroom in an existing middle school to a computer assisted science room for seventh graders.

The unique character of this design evolved from the desire to give the teacher a spectrum of tools to individualize instruction in order to teach more effectively. Electronically,

the system design creates a common carrier for educational services in an open architectural environment. The operating system delivers a seamless integration to the student allowing for individual instruction and personalized learning to take place. The system can be modified and up-graded to accommodate on-going student curriculum and instructional needs.

Specially designed desks conceal personal computers with color monitors under glass beneath the desk tops. In the first generation Smart-Classroom each desk serves two students who share a keyboard that is stored in a drawer when not in use. The student work station houses electronic hardware that is capable of receiving visual, aural, verbal, and numeric information managed by a computer linked to a network of central data bases. The student work station is used for the acquisition of knowledge based education through high level thinking skills, and is linked to the electronic networking system creating the data base necessary for individualized instruction. With a flat surface, the student work station can be used for wet as well as dry science experiments. The proximity of the student work stations and the swivel chairs allow for cooperative learning to take place, fully integrating student resources into problem solving and application activities.

The geometry of the desks creates concentric rings when joined together. One group of desks is raised on a platform. The resulting arrangement is rather like that of a symphony orchestra with the teacher as the conductor. The teacher has a

master computer terminal instead of a baton to help conduct the classroom. The design allows the technology to be the dispenser of information, and the teacher to be the facilitator of learning. It is obvious to the observer that technology may be able to disseminate more facts than the teacher but only the teacher can orchestrate student learning. In the Smart-Classroom everything helps encourage the relationship between the student and the teacher.

An interactive network connects all the computers in the room allowing the teacher to call up various interactive instructional programs and deliver them to individual computers. Other learning resources at the teacher's command include a video projector and a large screen which motors out of the ceiling at the touch of the keyboard. Another key dims the lights which are designed not to create glare on the monitors. A color video camera can zoom in for closeups on the demonstration table and project a twelve foot high image on the screen. Other keys access laser disk interactive programs or compact disk stereo information. A video cassette recorder and a large satellite disk provide other sources of programs that can be shown on the large screen or delivered to individual monitors, all controlled from the teacher's keyboard.

The classroom created is virtually paperless, with students performing all their studies by computer. Other learning resources such as textbooks, scientific manuals, etc., are also available. Testing and student record keeping are also

computerized so the teacher has more time for individualized instruction.

An interactive laser disk retrieval program is used by students for problem-solving, application, and evaluation. An Apple electronic subsystem allows for further development of higher order thinking skills in a cooperative environment. Students also have at their fingertips the information from a complete set of encyclopedias--stored on a five inch compact disk. Computer printers coupled with word processing software allow students to work on scientific writing skills. A microwave dish provides the classroom with cable and satellite television and a national weather satellite network. The networking system can also be extended into the home linking the student to the Smart-Classroom through a simple telephone modem connection. These systems combined with robotics and the computer management system that integrates administrative functions with our specific science curriculum creates a fully integrated curriculum.

Pre-testing of students for aptitudes and learning modalities enables the teacher to place students in the appropriate curriculum with the appropriate learning resource, and in appropriate peer study groups. Using the "Learner Profile," the teacher can determine each student's learning style, attitudes, and preferences, allowing the teacher to custom design the instruction. The computerized testing system manages the path of instruction. Once a student work group becomes familiar with a piece of technology in the classroom, they then

have the responsibility to teach other students to use that technology and to work cooperatively on objective mastery and skill application exercises. In this way, student interaction is increased and the teacher has more time for individualized instruction.

## First Generation Smart-Classroom Results

The following information is a summary of the teacher's evaluation of student performance in the classroom.

First Semester. There were 192 students enrolled in the Smart-Classroom during the first semester of the 1987-88 school year. In addition to the regular seventh grade students, the six classes included students from the gifted and talented education program, the special education program, limited English proficient students, and three eighth grade aides.

The curriculum included 17 units in the areas of life, earth, and physical science. Each unit was correlated with state framework addendum, current textbooks, McGraw Hill California Achievement Test, and the California Assessment Program tests. Edunetics/Prentice-Hall software was used as the core of the program to teach students the basic concepts, skills, and vocabulary. IBM software was used for enrichment and allowed advanced students to progress up to the twelfth grade level. Students applied skills in simulation software on the Apple computers and developed problem solving skills on robotics.

Evaluation of student progress in the Smart-Classroom was based on:

- mastery of objectives
- ability to apply skills in real life situations
- student attitudes toward learning
- ability of student to work with others to solve problems

Mastery of Objectives. At the end of each unit, criteria reference computer tests were given to determine if content objectives were mastered. Any objectives missed were automatically retaught by the software program and tested again. This individualized approach enabled students to master the objectives at their own speed. By the end of the third unit, 98 percent of the students were able to master all of the unit objectives with mastery set at 90 percent.

Ability to Apply Skills in Real Life Situations. Often, in a traditional classroom giving a test to determine mastery is where the evaluation stops. However, it is whether the student can take the information and apply it that is important. This application was a major part of the evaluation process in the Smart-Classroom. Students, often working with a partner, were given real life situations to apply their skills. Teacher observation and points earned determined the success of the students. Grades earned at the semester showed all students were able to successfully apply skills.

Student Attitude Toward Learning. If there was one area where the improvement was the most evident it was in the students' attitudes toward learning. Students were given the

chance to start at their appropriate level and to progress at their own speed. As they experienced success, they also gained confidence in themselves. They realized they could learn and that learning can be fun. Students tried hard to progress as far as they could and were eager to accept new challenges. Not only was this evident by grades and teacher observation, but also in the way students worked together to solve problems and in the positive feedback from parents.

Ability of Students to Work Together to Solve Problems. Every student was given the opportunity weekly to work with a partner or small group to develop problem solving skills. Students worked in cooperative groups on hands-on activities, robotics, or problem solving software. Again, students showed a great deal of progress in this area. This was evident in the behavior of the students, the difficulty level of the project they were able to complete, and their attitudes.

There were no discipline problems during the first semester. The behavior of the students was excellent.

Second Semester. A new teacher was introduced into the Smart-Classroom for the spring 1988 semester. This teacher was essentially computer illiterate with experience and training as an elementary teacher.

The second semester of the 1987-88 school year in the Smart-Classroom proved to be very productive and successful for students. During this semester there were approximately 167 students enrolled in five sections of seventh grade science.

Within this student population the following percentages of students were enrolled in additional programs: 5 percent special education, 4 percent gifted and talented education, 2-1/2 percent limited English proficient/non-English proficient, and 1 percent visually handicapped. There were also two eighth grade student aides.

The classroom continued to integrate the use of computers, CD-ROM, satellite T.V., interactive laser disk video, and robotics.

Lego Logo robotics was added to the curriculum and proved to be a great addition to the classroom. This learning resource provided students with another means of applying the skills and concepts taught in the classroom.

The WICAT system was also re-introduced into the classroom during the semester. Sixteen stations had full access to the WICAT learning material. This addition was primarily for the purpose of teaching math/scientific concepts.

The most exciting addition during the spring semester was the home-to-school modem system. Even though it was tested with a very limited number of students it proved very successful. The students on special class contracts were allowed to stay home during their normal class period three days per week to work at home via the home/school system. Each student kept a journal of his/her experience, the time necessary to complete the lessons, and questions regarding this material. The students attended class two days per week in order to receive direct instruction,

do application and problem solving activities, and to meet with the teacher to discuss their progress through the lessons. The students and parents proved to be highly supportive of the program which offers potential for significant changes to the traditional school day.

Edunetics/Prentice-Hall software was utilized as the unified curriculum to teach basic science skills, concepts, and vocabulary. Seventeen prepared units on the network system in the classroom were utilized. The covered areas were within the life, biological, and physical sciences. Each unit had correlation with the state framework addendum and the California Assessment Program and the McGraw-Hill California Achievement Tests. IBM software was used for student enrichment and allowed many students to continue on past the basic curriculum. Students also applied their skills and developed problem solving skills utilizing the Apple computers and robotics. Students researched classroom science topics with the CD-ROM. Students found this learning resource useful in preparing science fair projects.

Evaluation of student progress in the Smart-Classroom was based upon mastery of objectives, skill application, completion of assigned classroom activities, and student attitude.

Mastery of Objectives. At the end of each module, criteria referenced computer tests were given to determine if unit objectives were mastered. Any objectives not mastered were automatically retaught by the software program and tested again. Ninety-four percent of the students were able to master all unit

objectives with mastery set at 90 percent. Ninety-nine percent of the students showed mastery of objectives when mastery was set at 80 percent. This is significant data in view of the 8-1/2 percent of the classroom population being students enrolled in either the limited English proficient/non-English proficient, special education, or visually handicapped programs.

Skill Application and Completion of Assigned Classroom Activities. Since the ability to apply learned skills is a determining factor in the retention of learning, the ability to apply skills learned and to complete simulation activities were considered as a major part of the student evaluation process in the Smart-Classroom. Many assignments were completed with partners or in cooperative group settings. The grades earned for the semester included 26-1/2 percent - "A," 48 percent - "B," 22-1/2 percent - "C," and 3 percent - "D," and no "F's." Those students in the "D" range were predominately students with school attendance problems or those labeled as high risk students who were receiving failing notices in their other classes. A "D" grade to these students indicated a growth in their school experiences.

Student Attitude. A truly significant factor involved student attitude and classroom morale. Students knew that they would be able to progress at their own speed and receive teacher help when needed. They experienced success and gained confidence in themselves. The students became eager to try new activities, programs, and have new challenges. Their ability to work

together with other students to solve problems was truly outstanding. Parent feedback indicated that students' attitudes were overwhelmingly positive about their participation in the classroom.

The Smart-Classroom definitely helped to protect and maximize teacher instructional time. The technology available in the classroom provided unlimited resources during direct instructional periods and also allowed students to progress through the units at their own pace. The teacher found it easy to spend ample time with individual students and small groups whenever necessary.

Teacher time spent on dealing with discipline problems was reduced to a fraction. There were no discipline problems. Student care of the equipment was commendable with no incidents of intentional damage. Study and attendance in class showed an increase of approximately 2 percent over their previous semester in the traditional science classroom.

These factors definitely served to increase student achievement, promote student success on concept application, and allow for a greater amount of material to be covered in one semester. Most students were able to cover 14 units in the 20-week period. The teacher observed that for the time it normally takes a student to master one objective in a traditional classroom, the Smart-Classroom student mastered three objectives.

## Overall Results

Overall results indicated student growth. Seventh grade standardized science test results were up over 1986-87 results. The proficiency level of the students' mastery of objectives and the time involved to complete mastery showed significant differences when compared with the traditional classroom.

For the first two quarters, students enrolled in a traditional science classroom ended with a grade point average of 2.75 compared with a grade point average of 3.36 for students in the Smart-Classroom. For the third quarter, when the two groups exchanged experiences, students transferring to the Smart-Classroom increased their grade point average by .50 while students transferring from the Smart-Classroom to a traditional classroom saw a drop in grade point average of .77.

During the first semester, there were approximately 90 percent parent contacts with 100 percent positive response.

An analysis of attendance patterns and discipline referrals indicates that the Smart-Classroom has had a positive effect on attendance and student attitude. For the first semester, seventh grade students enrolled in the Smart-Classroom had an attendance roll of 98.06 percent compared to 96.22 percent for students in the traditional classroom. During the first semester there were no discipline referrals for students enrolled in the Smart-Classroom. During the third quarter there were 13 discipline or academic referrals for the same group of students now enrolled in a traditional science classroom.

The Smart-Classroom and the Smart application of the Hueneme technology has attracted visitors from all over the United States. In the 1987-88 school year, the Governor of California visited the Classroom, as well as over 250 people from various school districts, private industries, and other countries. The district has had requests for information from more than 200 school districts, as well as private sector people. Various magazine articles and newspaper stories have highlighted the Smart-Classroom and its application. The school district's Smart-Classroom has been the main agenda for a high-tech conference at Pennsylvania State University, part of The Fifth International Conference on Technology and Education in Edinburgh, Scotland, and has been highlighted at various other school-related conferences. United States and Canada Television news broadcasters and radio stations have also featured the Smart-Classroom. Turner Cable Net-working News (CNN) did a feature on the Smart-Classroom for the world audience.

The Second Generation Smart-Classroom

In September of 1988, the Hueneme School District will open the second generation Smart-Classroom at Blackstock Junior High School. The second generation Smart-Classroom fulfills the promise of the first generation classroom and continues to open up a window of opportunity on interactive electronic education.

The design of the second generation classroom is essentially the same as the first generation. The second generation classroom allows for 36 individual learning stations. The

networking capability will go as high as 90 individual learning stations.

New GTE/GTEL technology and Software Management Service's technology brings to the learning station a multitude of prescribed learning resources. GTEL's monitor control unit allows for instant electronic switching to the appropriate learning resource. The electronic switching enables the student to move in a continuous progress through subject content and skill mastery.

Dissimilar technologies will be capable of integrating electronically into the common delivery system. The switching capabilities of the GTEL monitor control unit allows for 36 different events going on simultaneously under program control with the capability to serve up to 90 or more student learning stations. The teacher will have the capability of viewing each individual student station on the teacher monitor and will be able to take a student's individual display and project it on the large screen.

Software Management Service's curriculum delivery system will manage the student learning path and has program control over the monitor control unit, thus assuring automatic switching to the appropriate learning resource as prescribed by the curriculum delivery system. The curriculum delivery system and the monitor control unit allow for automatic vertical and horizontal branching within the unified curriculum software and out to the co-curriculum learning resources. This system will

also provide for exception type reporting to teachers and counselors to help guide them towards student learning problems that are not diagnosed inside the classroom.

The second generation classroom will increase the electronic learning resources by stacking up to eight interactive laser disk programs and four VCR players. Surround sound will be used to enhance student learning. The system will be capable of networking one CD-ROM player to eight separate learning stations. Apple's and Software Management Service's technology will allow for the integration of Apple hardware and software into the common delivery system creating a seamless interface with the curriculum delivery system and the monitor control unit. GTE's technology will allow for the operation of an interactive video system for home to school and classroom to classroom instruction. New IBM touch screen technology and software will be used to help teach seventh grade science students who are limited in English proficiency.

GTE/GTEL will establish standards or characteristics that are required for <u>all</u> software vendors to participate in the Smart-Classroom's multi-vendor environment. The open electronic architecture will allow districts to add and modify electronic curriculum as needed. School districts will now have the opportunity to control the curriculum that will drive the student delivery system.

The science curriculum has been enhanced by adding a diagnostic test that will reveal achievement diagnostics as well

as scientific processes diagnostics. Not only will the teacher know what content material the student needs to master, the software will reveal what scientific skills are necessary for the student to master a particular content objective. Up to 178 learning curriculum resources have been programmed to accommodate for individual student achievement, learning styles, learning speed, and motivation.

The science curriculum will have the depth and breadth of content to allow for individual pacing and continuous progress in the learning cycle. The curriculum will also call on the student's ability to answer questions in an expository mode.

The testing portion of the curriculum delivery system will function external to all the classroom learning resources and under program control will seek out the most appropriate learning resource for student mastery on a particular objective or set of objectives. All information will be stored, catalogued, and programmed for teacher use in determining the students learning path.

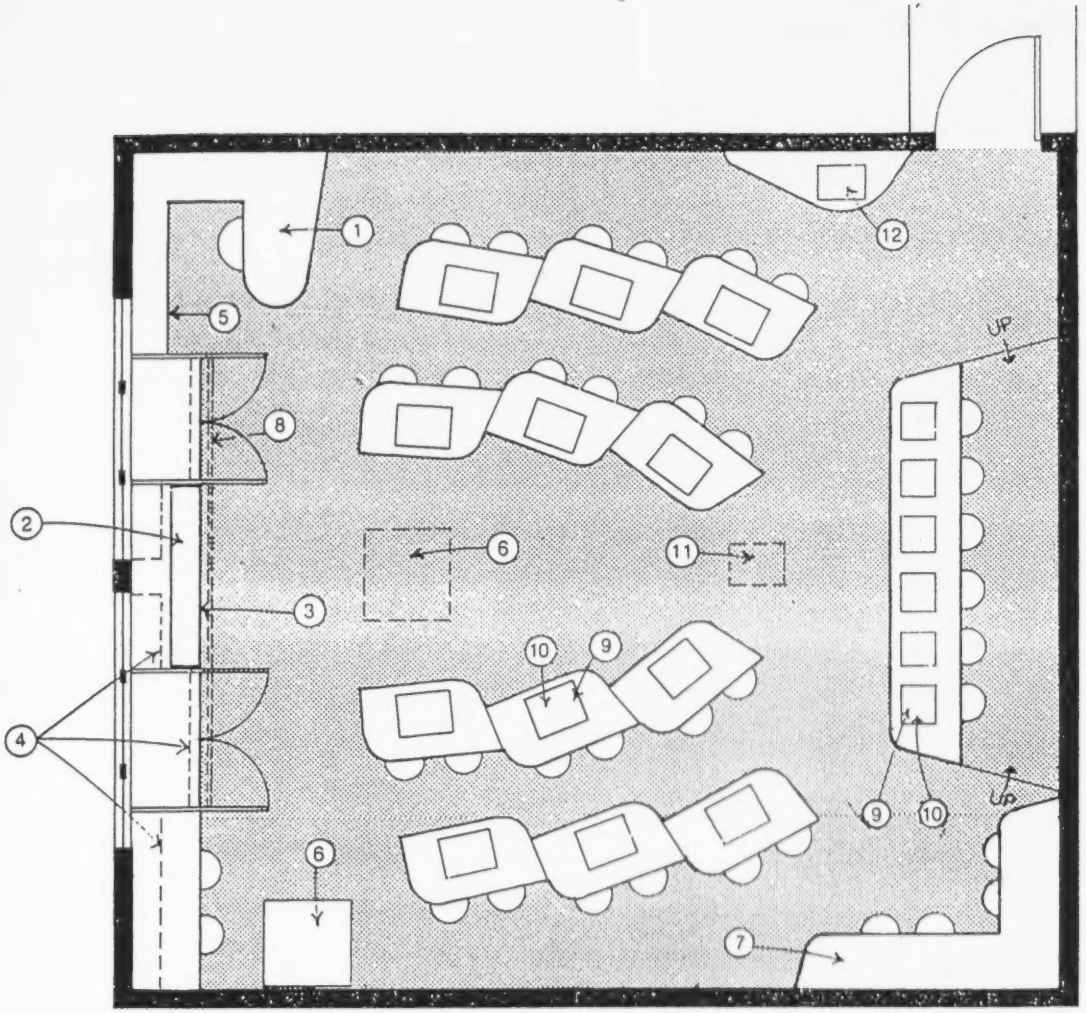
## Conclusion

The Smart-Classroom opens up a window of opportunity to significantly change the traditional education delivery system, allowing all learning to become interactive and personalized.

The Smart-Classroom is merely the first step of the ultimate vision; the next step is the Smart-School where all the classrooms of one school are linked together by technology, and

then a district-wide network that can also be extended into the home. Ultimately, every child will be linked to the Smart-District.

The Smart-Classroom is a technological bridge from the traditional classroom to the future. A future where we will not find a forgotten child in the back of the room; a future where the teacher will not be looking at a sea of vacant faces; and a future with a promise that all children can learn--and all teachers can teach.




FIRST GENERATION SMARTCLASSROOM - OPEN MAY 1987

## LEGEND

1. TEACHERS STATION
2. PULL DOWN LIGHT TABLE/ROBOT PLOTTER
3. CHALK BOARD
4. CABINETS ABOVE
5. 30" HIGH COUNTER
6. DEMONSTRATION TABLE
7. LASER DISK STATION WITH CABINETS BELOW
8. RETRACTABLE SCREEN (RECESSED)
9. TEMPERED GLASS
10. COMPUTER MONITOR RECESSED IN DESK
11. VIDEO PROJECTOR ABOVE
12. SINK

COMPUTER-TUTOR CLASSROOM DESIGN

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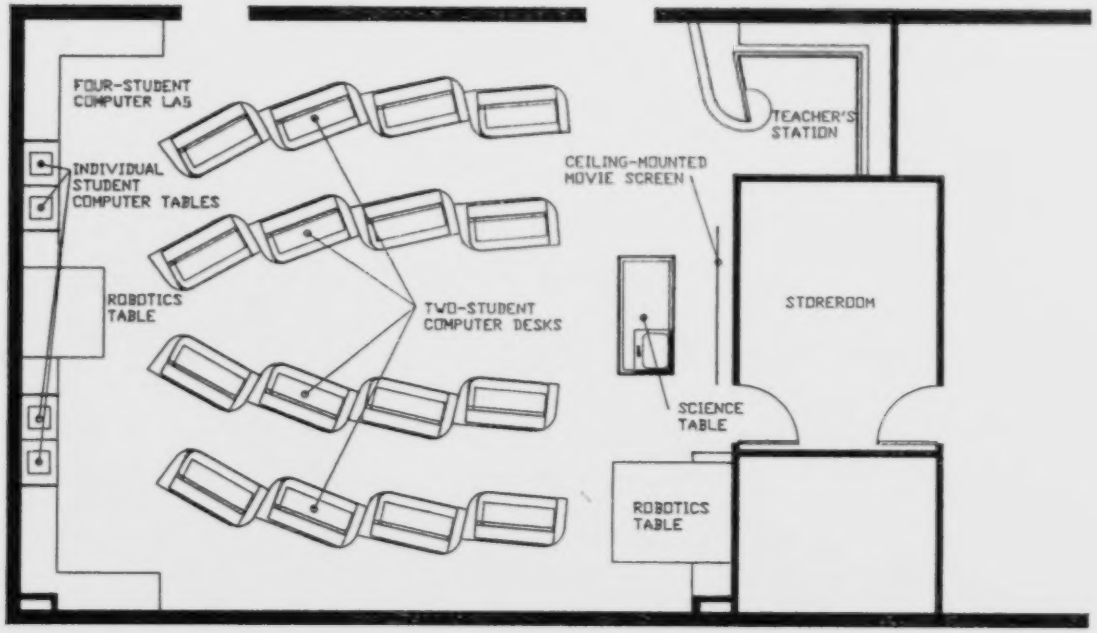


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# SECOND GENERATION SMART CLASSROOM
# BLACKSTOCK JUNIOR HIGH SCHOOL - OPEN SEPTEMBER 1988

SCOTT ELLINWOOD & ASSOCIATES

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